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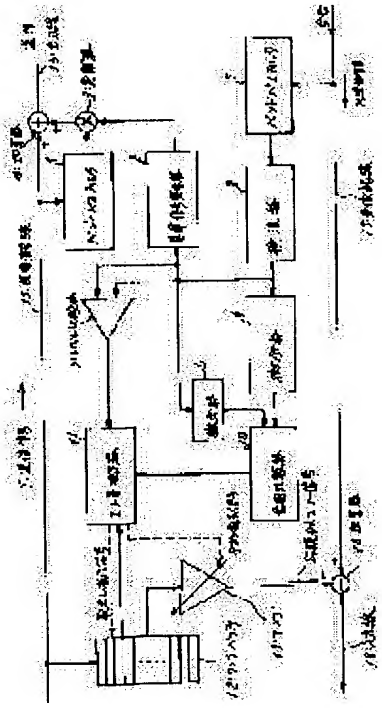
(54) ECHO CANCELER

(57)Abstract:

PURPOSE: To cancel echo with pseudo echo generated based on the delay time of a returned reference signal by sending the reference signal defining the specified frequency component of a transmitted signal as a carrier wave.

CONSTITUTION: A ring buffer 12 samples a transmitted signal T in the cycle of 125μs and time sequentially stores amplitude data for 250ms. A reference signal generator 2 extracts the frequency component of 2400± 50Hz in the transmitted signal and sends out the reference signal modulated by the rectangular wave of 250ms as the carrier wave. A level comparator 5 finds an amplitude ratio from the amplitudes of the reference signal returned through a BPF 7 and the transmitted reference signal. A phase comparator 10 finds the delay time of the transmitted reference signal and the returned reference signal. An echo quantity estimator 11 specifies correspondent data in the ring buffer 12 and outputs the pseudo echo, for which these data are adjusted by the amplitude ratio, through an amplifier 13. An adder 14 subtracts the pseudo echo from a received audio signal and cancels the received echo.



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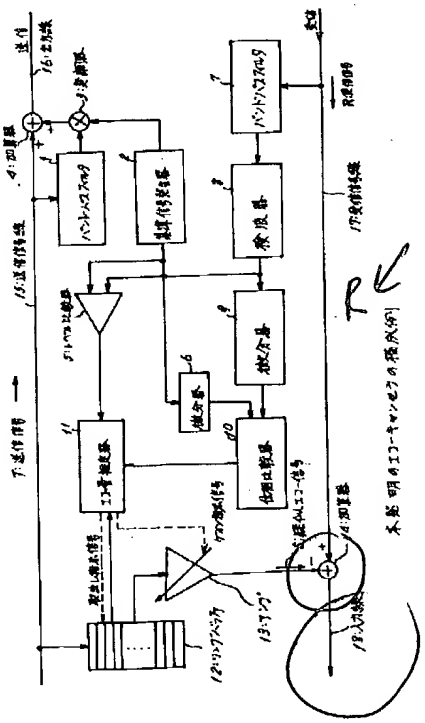
(54)【発明の名称】　エコーキャンセラ

(57)【要約】

【目的】　エコー時間の長短に関わらずキャンセル処理量が一定になるエコーキャンセラを提供すること。

【構成】　自局から送信される音声信号を常時サンプリングしサイクリックに順次時系列に格納するリングバッファ１２と、相手局へ送信する音声信号の特定の周波数成分を抽出し搬送波として使用し周期的に発生する基準信号を送出する基準信号発生２と、該送出する基準信号と相手局から戻って来る基準信号の振幅を比較し振幅比を求めるレベル比較手段５と、該送出する基準信号と相手局から戻って来る基準信号の遅延時間を求める位相比較器１０と、該遅延時間からリングバッファ１２との所定のデータ位置を求め該データを振幅比に合わせて調整し疑似エコーＳを出力するエコー量推定器１１とアンプ１３を具備する疑似エコー出力手段と、相手局から受信した音声信号から該疑似エコーＳを減算し該受信した音声信号に含まれるエコーを打ち消す手段１４を設けたエコーキャンセラ。



DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Industrial Application] This invention relates to the echo canceller which negates the echo which returns from a distant office through the telephone line.
[0002]
[Description of the Prior Art] By the long-distance telephone circuit, since its voice is delayed through the telephone equipment of the other party and it returns, it may become an echo and a remarkable failure may be done to a message. The equipment for preventing this is an echo canceller, and is installed in the transceiver circuit of the main unit of telephone equipment etc. Drawing 3 is the block diagram showing the configuration of the conventional echo canceller. The conventional echo canceller possesses the FIR filter (non-recursive filter) 30, the renewal section 34 of a multiplier, and an adder 35 so that it may illustrate. the delay element 31-1 of plurality [filter / 30 / (non-recursive filter) / FIR], 31-2, ..., amplifier 32-1, 32-2, and ... it has an adder 33, and it is constituted so that the multiplier (gain) of the FIR filter 30 may be set up in the renewal section 34 of a multiplier.
[0003] As for each delay element 31-1 of the FIR filter 30, 31-2, and ..., a time delay is set up, it connects with a serial from the sending-signal line 36, amplifier 32-1, 32-2, and ... are connected from each node, and the output of each amplifier is connected to the input of an adder 33. Furthermore, the output of an adder 33 is connected to the input of an adder 35 with the receiving signal line 37. The output of an adder 35 is connected to the input of the renewal section 34 of a multiplier, and the output of the renewal section 34 of a multiplier is connected so that the gain of each amplifier may be adjusted.
[0004] While a sending signal is transmitted to a station from the sending-signal line 36, it is inputted into each amplifier through each delay element 31-1, 31-2, and ..., and the output signal of each amplifier is added with an adder 33, and generates false echo signal s. It is inputted into the renewal section 34 of a multiplier while reception of the input signal which received with the receiving signal line 37 is carried out, after false echo signal s is subtracted with an adder 35. The renewal section 34 of a multiplier possesses CPU (central processing unit), it adjusts the gain of each amplifier so that the echo signal included in an input signal may become min, and it outputs false echo signal s with the optimal adder 33. The echo signal included in an input signal changes with telephone lines, and the renewal section 34 of a multiplier is attaining optimization of false echo signal s by learning repeatedly for every telephone line.
[0005]
[Problem(s) to be Solved by the Invention] However, when echo time (time amount until the echo of a sending signal returns) was long, the conventional echo canceller described above needed to increase the delay element of the FIR filter (non-recursive filter) 30, and the number of amplifier, and the processing which optimizes the multiplier (gain) of each amplifier became a huge amount, and it had the problem which says that processing becomes impossible in the renewal section 34 of a multiplier.
[0006] It aims at offering the echo canceller to which this invention was made in view of the above-mentioned point, removes the above-mentioned trouble, and is not concerned with the merits and demerits of echo time, but cancellation throughput becomes fixed.
[0007]
[Means for Solving the Problem] It is the echo canceller which negates the echo signal which this invention is prepared in telephone in order to solve the above-mentioned technical problem, and is included in a sound signal from a distant office. A voice data storing means to always sample the sound signal transmitted from a local station, and to store in time series one by one cyclically (12), A reference signal sending-out means to send out the reference signal which extracts the specific frequency component of a sound signal which transmits to a distant office, uses as a subcarrier, and is generated periodically (2), A magnitude-comparison means to compare the amplitude of the this reference signal to send out and the reference signal which returns from a distant office, and to ask for a gain (5), A

phase-comparison means to find the time delay of the this reference signal to send out and the reference signal which returns from a distant office (10), A false echo output means to adjust these data according to a gain in quest of the predetermined data location of a voice data storing means (12) from this time delay, and to output the false echo S (the amount presumption machine 11 of echoes, and amplifier 13), It is characterized by establishing a means (14) to negate the echo which subtracts this false echo S from the sound signal received from the distant office, and is included in the this received sound signal.

[0008]

[Function] In this invention, since an echo is presumed by the time delay from the gain at the time of transmission of a reference signal, and reception, and transmission of a reference signal to reception, and the false echo S is computed from the data of the stored sound signal and it subtracts from the received sound signal as explained above, the throughput of a false echo output means becomes fixed regardless of the merits and demerits of echo time. Therefore, the message stabilized regardless of the merits and demerits of echo time can be expected, without increasing a hardware component like before. Moreover, since the subcarrier which sends a reference signal is extracted from a sending signal, its failures, such as a noise, also decrease.

[0009]

[Example] Hereafter, one example of this invention is explained to a detail based on a drawing. Drawing 1 is the block diagram showing the configuration of the echo canceller of this invention. The echo canceller of this invention possesses a band pass filter 1, the reference signal generator 2, a modulator 3, an adder 4, the level comparator 5, a differentiator 6, a band pass filter 7, a wave detector 8, a differentiator 9, a phase comparator 10, the amount presumption machine 11 of echoes, the ring buffer 12, amplifier 13, and an adder 14 so that it may illustrate.

[0010] The sending-signal line 15 is connected to the input of a band pass filter 1, and one input of an adder 4, the output of a band pass filter 1 is connected to the input of a modulator 3 with the output of the reference signal generator (square wave generator) 2, the output of a modulator 3 is connected to one input of an adder 4, and the output of an adder 4 is connected to the output line 16.

[0011] The receiving signal line 17 is connected to a wave detector 8 through a band pass filter 7 while connecting with the input of an adder 14. The output of a wave detector 8 and the output of the reference signal generator 2 are connected to the input of a phase comparator 10 through a differentiator 9 and a differentiator 6, respectively while connecting with the input of a level comparator 5.

[0012] The output of a level comparator 5 and the output of a phase comparator 10 are connected to the input of the amount presumption machine 11 of echoes, and the output is connected to the gain-adjustment terminal of the ring buffer 12 and amplifier 13. The sending-signal line 15 is connected to the input of the ring buffer 12, the output of the ring buffer 12 is connected to the input of amplifier 13, the output of amplifier 13 is connected to the input of an adder 14 with the receiving signal line 17, and the output of this adder 14 is connected to the input line 18.

[0013] The ring buffer 12 is storage which always samples a sending signal T (sound signal) with the sampling period for 125 microseconds, and stores a minute of data (amplitude) by time series one by one cyclically for 250ms.

[0014] Next, actuation is explained. A 2.4kHz**50Hz signal is extracted by the band pass filter 1, the output signal is modulated with a modulator 3 with the output signal (square wave in a cycle of 250ms) of the reference signal generator 2 (amplitude modulation), the output signal of a modulator 3 is added with a sending signal T and an adder 4, and a sending signal T (sound signal) is outputted from an output line 16.

[0015] It is received by the receiving signal line 17, and a 2.4kHz**50Hz signal is extracted through a band pass filter 7, a reference signal restores to an input signal R with a wave detector 8, signal amplitude is compared by the output signal (square wave in a cycle of 250ms) and level comparator 5 of the reference signal generator 2, and the gain at the time of transmission of a reference signal and reception is outputted. Furthermore, the signal to which it restored with the wave detector 8 is differentiated with a differentiator 9, the output signal of the reference signal generator 2 is differentiated with a differentiator 6, both standup parts are extracted, a phase is compared by the phase

comparator 10, and the time delay from transmission of a reference signal to reception is outputted to the amount presumption machine 11 of echoes.

[0016] The amount presumption machine 11 of echoes presumes the amount of echoes from the output signal (gain) of a level comparator 5, and the output signal (time delay) of a phase comparator 10, and generates a false echo signal (detail after-mentioned). That is, the location which picks out predetermined data from the data (data stored by time series) stored in the ring buffer 12 is specified, and the gain of the amplifier 13 which amplifies said data is directed. Amplifier 13 sets up gain according to directions of the amount presumption machine 11 of echoes, and outputs the signal (false echo signal S) according to said data to an adder 14. An adder 14 subtracts false echo signal S from an input signal R, and outputs it to an input line 18.

[0017] Drawing 2 is a flow chart which shows actuation of the amount presumption machine of echoes. The amount presumption machine 11 of echoes possesses CPU and memory (it omits by a diagram), and the program which performs this flow chart is stored in the memory of the amount presumption machine 11 of echoes, and is performed by CPU. It explains according to the flow chart of drawing 2 . The amount presumption machine 11 of echoes reads the output signal of a level comparator 5 and a phase comparator 10 (step ST 1).

[0018] The ejection location of the ring buffer 12 is decided based on the output signal of a phase comparator 10 (step ST 2). The gain of amplifier 13 is determined based on the output signal of a level comparator 5 (step ST 3). The output (output to amplifier 13) of data is directed to the ring buffer 12 (step ST 4), a setup of gain is directed to amplifier 13, and data are made to output as false echo signal S (step ST 5). The above step ST 1 - step ST 5 are repeated and performed.

[0019] The above-mentioned explanation was Eko-can SENRA by the side of call origination, and the band pass filter 1 extracted the signal of a 2.4kHz**50Hz narrow-band which seldom influences consciousness in a sending signal T (sound signal), and used with the reference signal (square wave in a cycle of 250ms), having applied the modulation. Moreover, the frequency band of Eko-can SENRA by the side of a call in should just use 2.6kHz**50Hz, in order to prevent the interference by the side of call origination. The frequency and frequency band on which the above-mentioned reference signal is put, and the period (250ms) of a reference signal and the ring buffer size (a part for storing for 250ms) relevant to it are the values used as an example, and may use other values.

[0020] Since according to this example the amount of echoes is presumed by the time delay from the gain at the time of transmission of a reference signal, and reception, and transmission of a reference signal to reception, false echo-signal S is computed from the data of the stored sound signal and it subtracts from an input signal R as explanation was given [above-mentioned], regardless of echo time, the throughput of the amount presumption machine 11 of echoes becomes fixed, and the message stabilized regardless of the merits and demerits of the echo time by the telephone line can be expected. Moreover, since the subcarrier which sends a reference signal is extracted from a sending signal, its failures, such as a noise, also decrease.

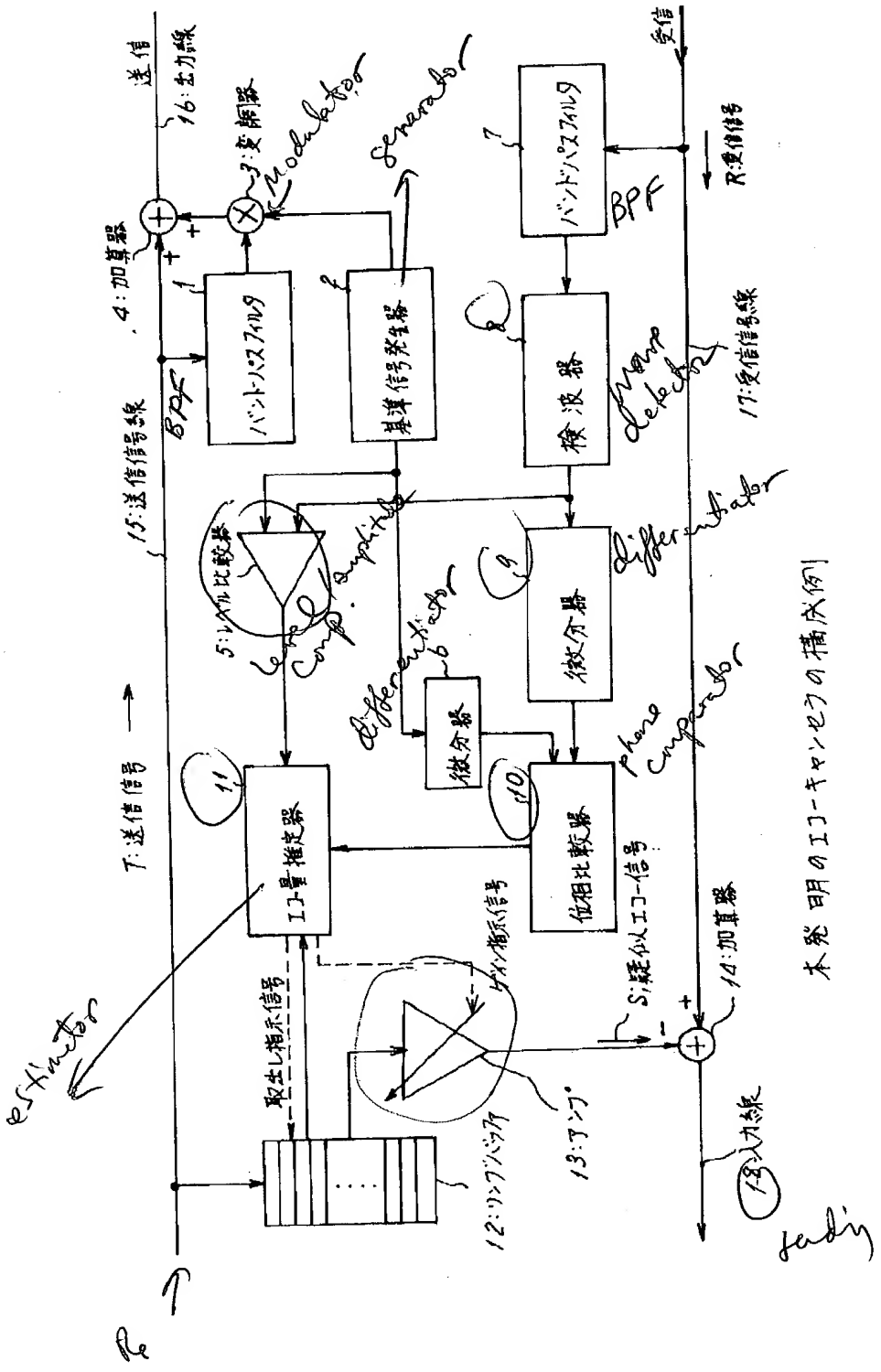
[0021]

[Effect of the Invention] As explained above, according to this invention, the following outstanding effectiveness is expected. Since an echo is presumed by the time delay from the gain at the time of transmission of a reference signal, and reception, and transmission of a reference signal to reception, and the false echo S is computed from the data of the stored sound signal and it subtracts from the received sound signal, the throughput of a false echo output means becomes fixed regardless of the merits and demerits of echo time. Therefore, the message stabilized regardless of the merits and demerits of echo time can be expected, without increasing a hardware component like before. Moreover, since the subcarrier which sends a reference signal is extracted from a sending signal, its failures, such as a noise, also decrease.

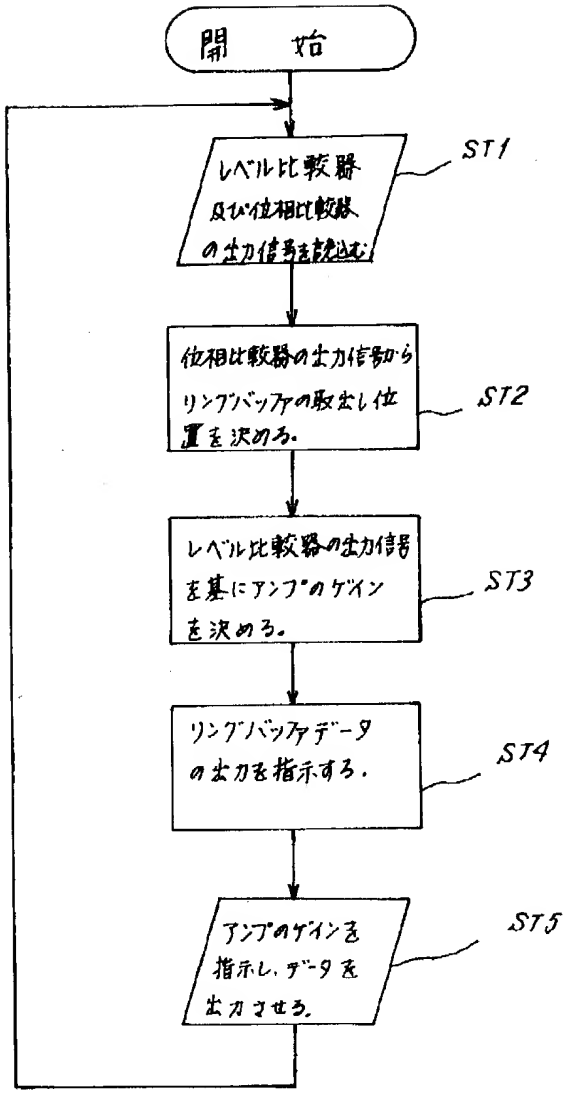
CLAIMS

[Claim(s)]
[Claim 1] The echo canceller which negates the echo signal which is characterized by providing the following, and which is formed in telephone and included in a sound signal from a distant office A voice data storing means to always sample the sound signal transmitted from a local station, and to store in time series one by one cyclically A reference signal sending-out means to send out the reference signal which extracts the specific frequency component of a sound signal which transmits to said distant office, uses as a subcarrier, and is generated periodically A magnitude-comparison means to compare the amplitude of the this reference signal to send out and the reference signal which returns from said distant office, and to ask for a gain A means negate the echo included in the sound signal which subtracted this false echo and this received from a phase-comparison means find the time delay of the this reference signal to send out and the reference signal which returns from said distant office, a false echo output means adjust these data according to said gain in quest of the predetermined data location of said voice-data storing means from this time delay, and output a false echo, and the sound signal received from said distant office

【図1】

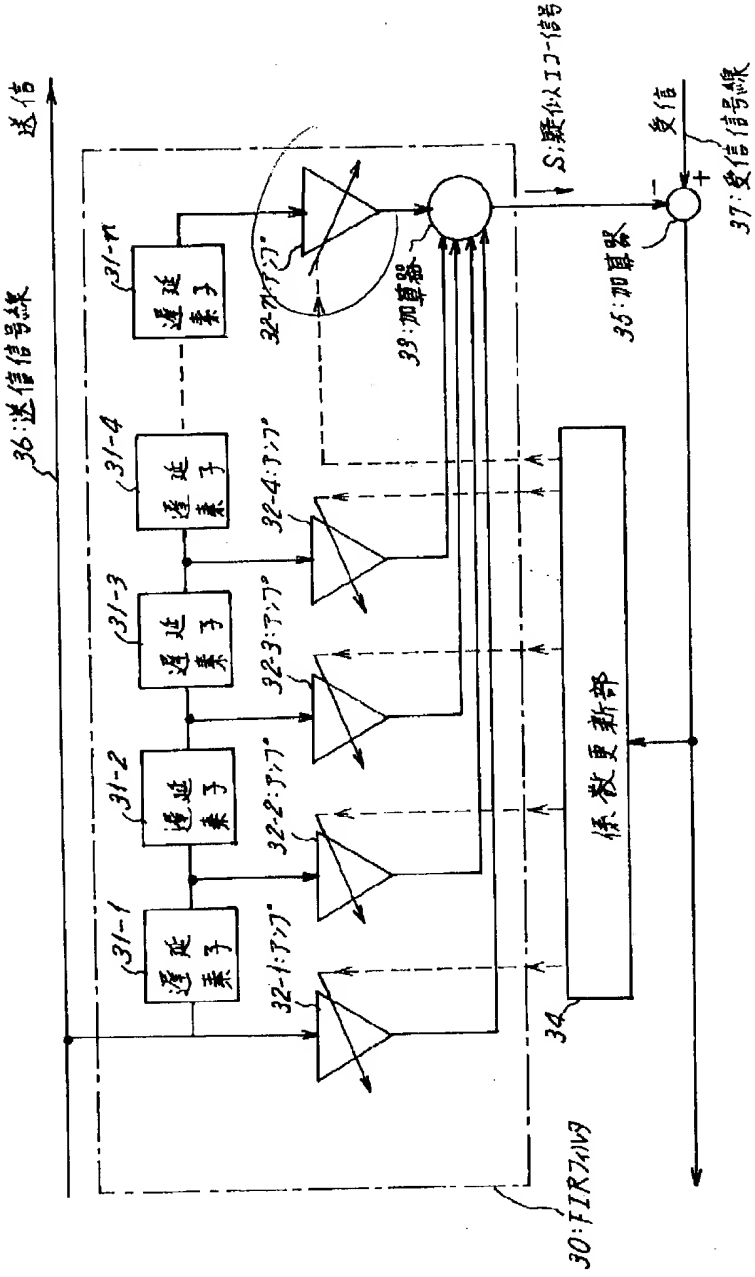

送信
16:出力線
3:変調器
Modulator
Generator
4:加算器
1
バンドパスフィルタ
BPF
2
基準信号発生器
7
バンドパスフィルタ
BPF
受信
R:受信信号
8
検波器
Envelope detector
17:受信信号線
15:送信信号線
5:レベル比較器
Level comp. circuit
9
微分器
Differentiator
6
微分器
Differentiator
11
エコー量推定器
10
位相比較器
Phase comparator
7:送信信号
取出し指示信号
メモリ指示信号
S:疑似エコー信号
14:加算器
12:リングバッファ
13:アンプ
18:入力線
Estimator
Feedback
本発明のエコーキャンセラの構成例

【図2】



エコー量推定器の動作を示すフローチャート

【図3】



従来のエコーキャンセラのブロック構成例